LITERATURE SURVEY

1. **A Survey of Handwritten Character Recognition with MNIST and EMNIST by Alejandro Baldominos , Yago Saez and Pedro IsasiComputer Science Department, Universidad Carlos III of Madrid, 28911 Leganés, Madrid, Spain.Published: 4 August 2019**

   This paper summarizes the top state-of-the-art contributions reported on the MNIST dataset for handwritten digit recognition. This dataset has been extensively used to validate novel techniques in computer vision, and in recent years, many authors have explored the performance of convolutional neural networks (CNNs) and other deep learning techniques over this dataset. To thebest of our knowledge, this paper is the first exhaustive and updated review of this dataset; there are some online rankings, but they are outdated, and most published papers survey only closely related works, omitting most of the literature. This paper makes a distinction between those works using some kind of data augmentation and works using the original dataset out-of-the box.

2. **Review on handwritten digit recognition by priya, rajendra Singh, DR. soni changlani ,Electronics communications and Engineering ,Laxmi Narayan College of Technology and Science, Raisen Road, Bhopal,India .published: 4 April 2017**

   An early notable attempt in the area of character recognition research was by Grimsdale in 1959. The origin of a great deal of research work in the early sixties was based on an approach known as analysis-by-synthesis method suggested by Eden in 1968. The great importance of Eden's work was that he formally proved that all handwritten characters are formed by a finite number of schematic features, a point that was implicitly included in previous works. This notion was later used in all methods in syntactic (structural) approaches of character recognition. K. Gaurav, Bhatia P. K. [5] Et al, this paper deals with the various pre-processing techniques involved in the character recognition with different kinds of images ranging from simple handwritten form-based documents and documents containing coloured and complex background and varied intensities. In this, different pre-processing techniques like skew detection and correction, image enhancement techniques of contrast stretching, binarization, noise removal techniques, normalization and segmentation, morphological processing techniques are discussed. It was concluded that using a single technique for pre-processing, we can’t completely process the image. However, even after applying all the said techniques might not possible to achieve the full accuracy in
   a pre-processing system.

3. **Handwritten Digit Recognition Using Various Machine Learning Algorithms and Models by Pranit Patil, Bhupinder K, International Journal of Innovative Research in Computer Science & Technology (IJIRCST) ISSN: 2347-5552,**

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Handwritten digit recognition is a technique or technology for automatically recognizing and detecting handwritten digital data through different Machine Learning models. In this paper we use various Machine Learning algorithms to enhance the productiveness of technique and reduce the complexity using various models. Machine Learning is an application of Artificial Intelligence that learns from previous experience and improves automatically through experience. We illustrate various Machine learning algorithms such as Support Vector Machine, Convolutional Neural Network, Quantum Computing, K-Nearest Neighbour Algorithm, Deep Learning used in Recognition technique.

4. **Handwritten Character Recognition: A Review Jayashree Rajesh Prasad Department of Computer Engineering, Sinhgad College of Engineering, University of Pune, Pune, Maharashtra 411048, India**

This paper presents an insight into the state-of-art in handwriting recognition systems and describes the evolution and progress in the field. An in-depth literature survey of Indic script recognition systems for Bangla, Devnagari, Gurumukhi, Kannada, Malayalam, Tamil, and Urdu are presented. This study focuses on a multitude of feature and classification techniques giving an insight into the efficacy of these methods for the various Indic scripts. The review explores new opportunities and challenges for future research in computational research areas e.g., imaging sciences.

5. **Handwritten Digit Recognition Using Deep Learning GaganashreeJ. S. Padmashali1* , Diksha Kumari 1,2Student, Department of Computer Science and Engineering, Srinivas Institute of Technology, Mangalore, India.**

In recent times, with the increase of Artificial Neural Network (ANN), deep learning has brought a dramatic twist in the field of machine learning by making it more artificially intelligent. The handwritten digit recognition problem becomes one among the most famous problems in deep learning and computer vision applications. Handwritten digit recognition is a crucial issue in pattern recognition applications. The applications of digit recognition include in postal mail sorting, check processing, form data entry, etc. the root of the problem lies within the ability to develop an efficient algorithm which will recognize handwritten digits and which is submitted by users by the way of a scanner, tablet, and other digital devices. This paper presents an approach to off-line handwritten digit recognition that supports different deep learning techniques. The objective of this paper is to make sure effective.

6. **Neural Network Based Handwritten Digit Recognition for Managing Examination Score in Paper Based Test Ankit Sharma , Yogi raj Barole , Kaustubh Kerhalkar , Dr. Prabhu K.R PG Students [Control & Automation], School of Electrical Engineering, VIT University, Vellore, Tamilnadu, India, Assistant Professor (Sr.), School of Electrical Engineering, VIT University, Vellore, Tamilnadu, India .**

   Recognition of handwritten characters is a difficult task in the field of image processing, artificial intelligence since the handwriting varies from person to person. In the proposed paper, we are training the neural network to recognize the off-line strategies for the isolated handwritten character (0 to 9). This work improves the character recognition and pre- processing of the Character is done by image rendering, character extraction and training and testing steps. The proposed method is based on the use of a linear regression algorithm to classify the characters and is used to train the given dataset. After training a network performance curve is generated along with the individual required characters. In a given system, numerical character is represented by binary numbers that are used as input then they are fed to an ANN. Neural network followed by the linear regression Algorithm which compromises Training.